Global Chemical Composition Forecasting During INTEX-NA Phase A:

Processes contributing to the O3 budget in the N. American upper troposphere

Insitu/Sonde data provided by:
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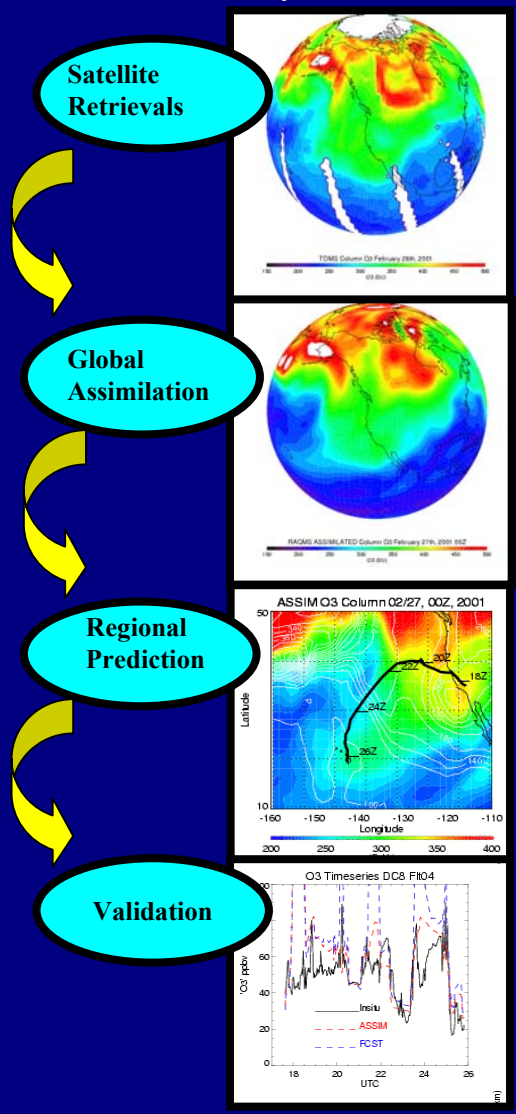
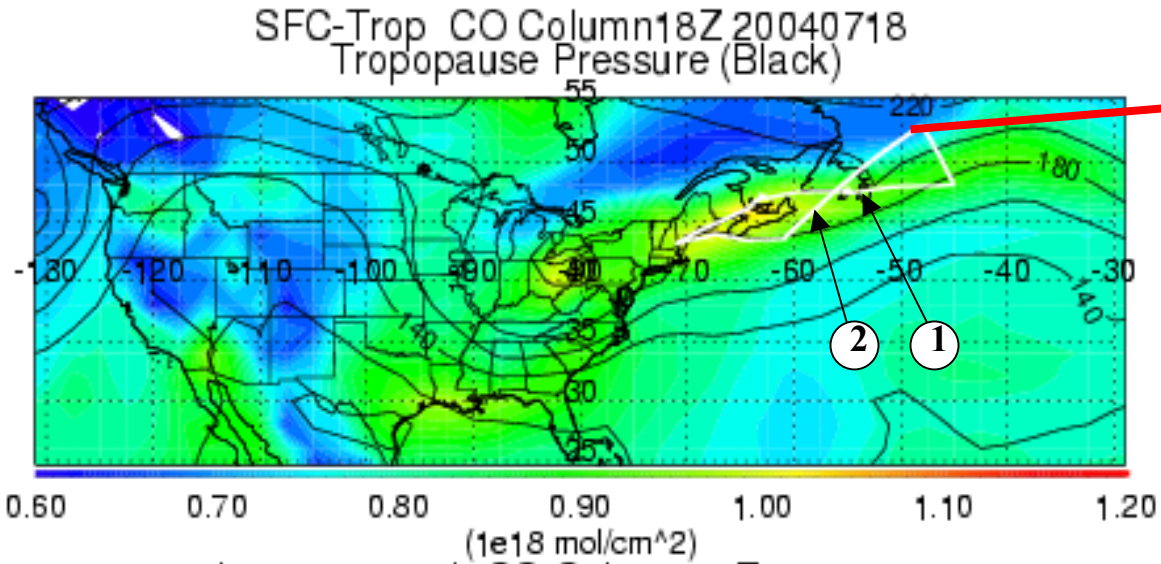
2°x2.5° Global component of the LaRC/UW-Madison Regional Air Quality Modeling System (RAQMS) uses the UW-Hybrid dynamical core, LaRC unified chemistry, and Statistical Digital Filtering (SFD) for real-time TOMS Ozone assimilation and chemical/dynamical predictions.

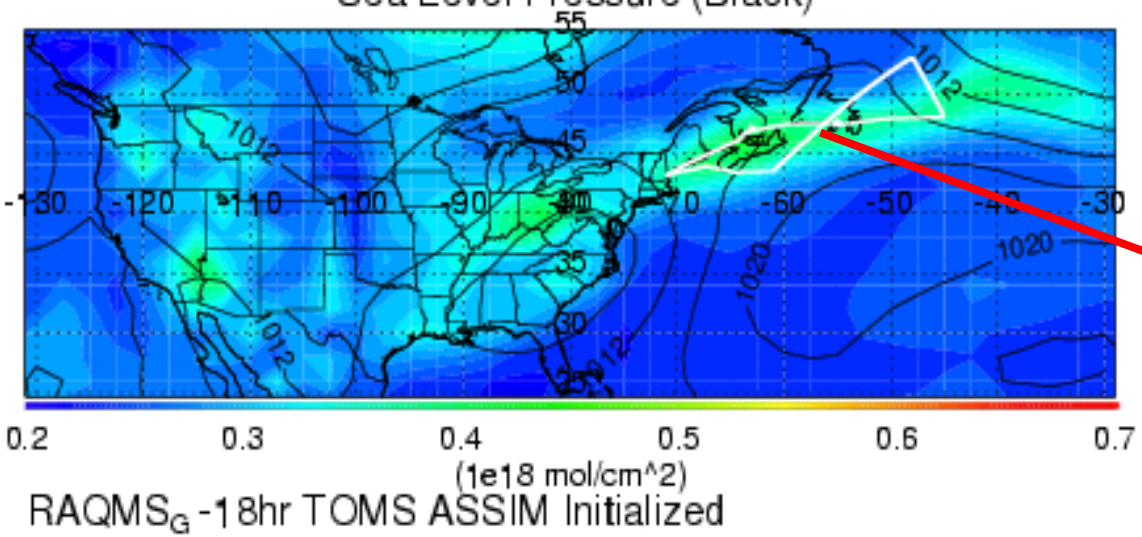
Regional Air Quality Modeling System (RAQMS)
Ozone Assimilation/Prediction
February 27, 2001



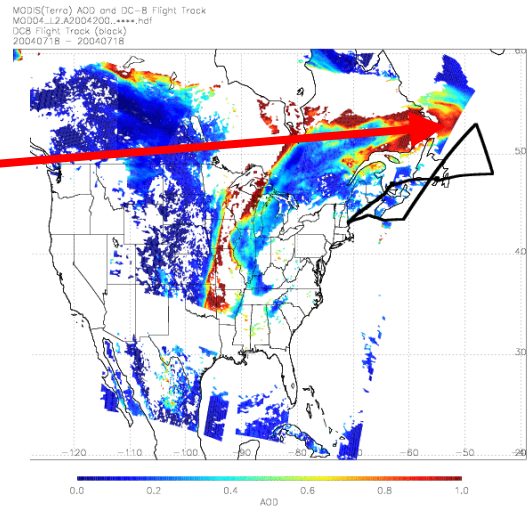
RAQMS [Pierce et al., 2003] is a nested global- to regional-scale meteorological and chemical modeling system for assimilating and predicting the chemical state of the atmosphere (air quality).

Case Study: DC8 Flight #9 July 18, 2004



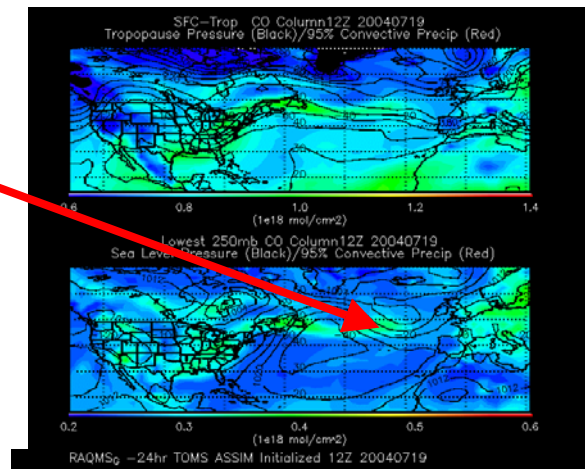


Alaskan Fires



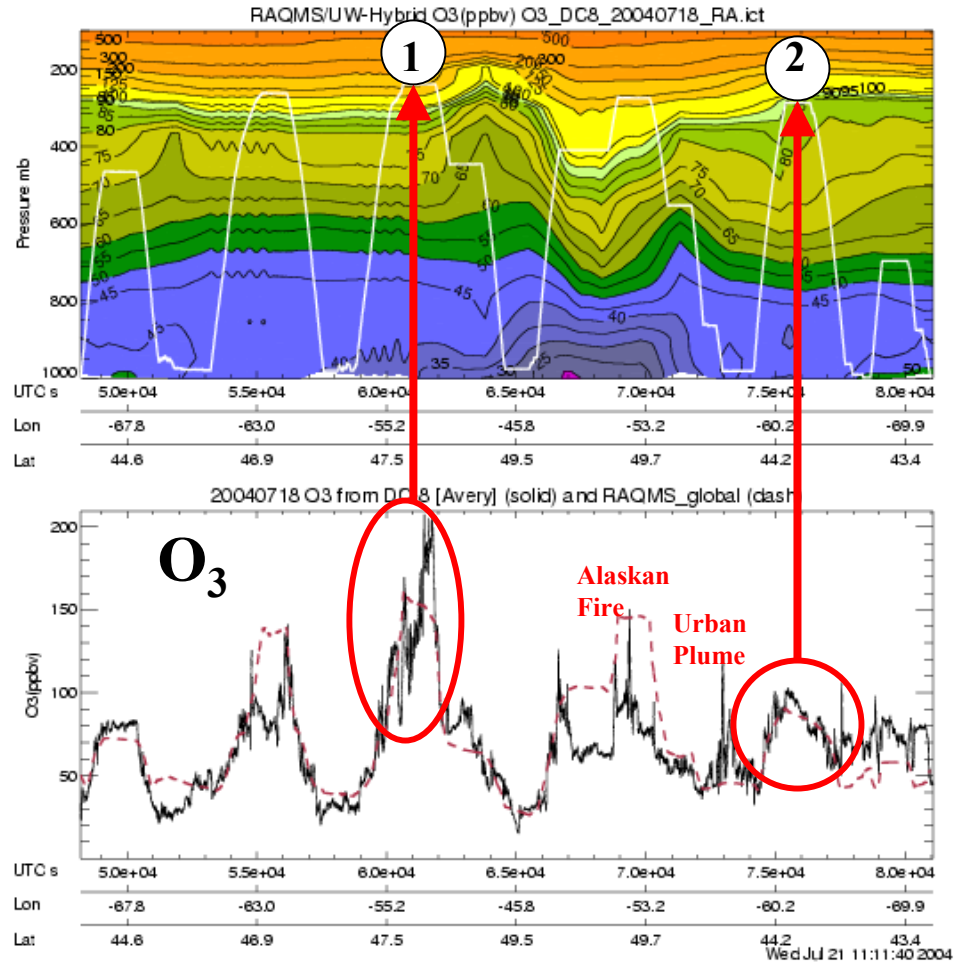
MODIS DB AOD (CIMSS, Liam Gumley)

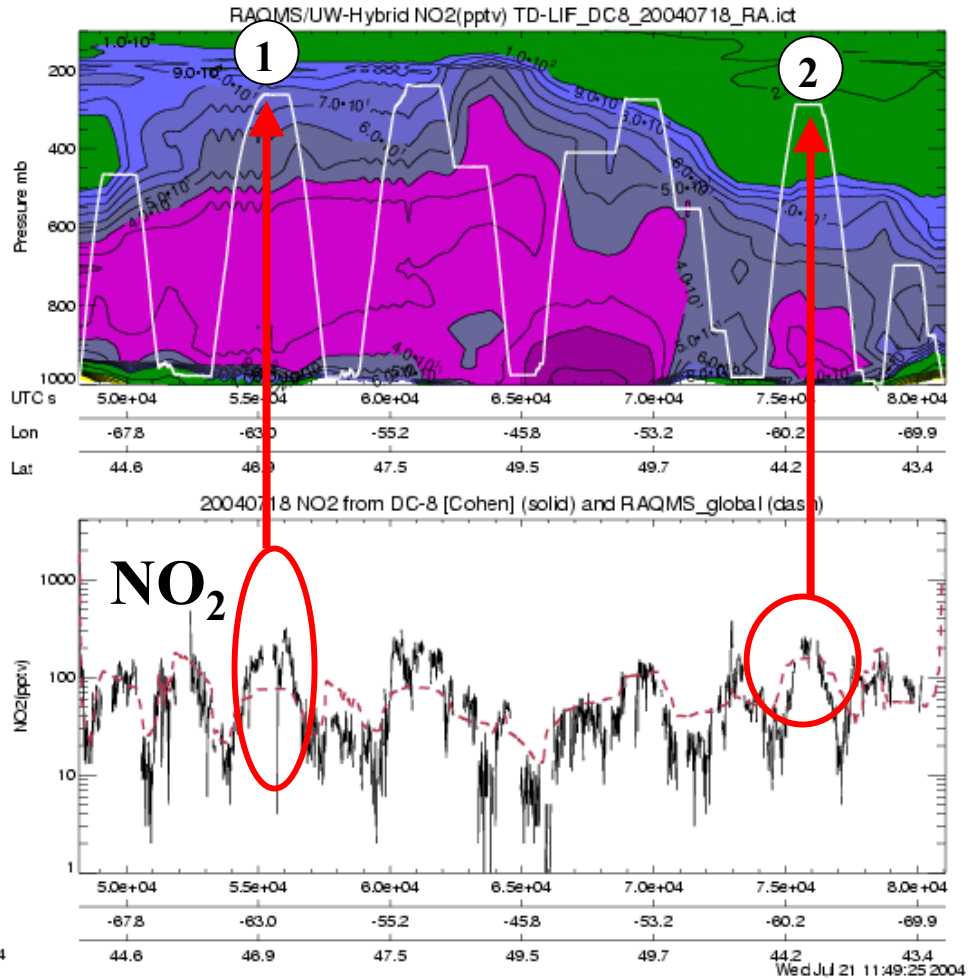
Lagrangian Opportunity



(Hx valid 12Z 07/19)

RAQMS/DC8 O_3&NO_2
DC8 flight # 9, July 18 2004



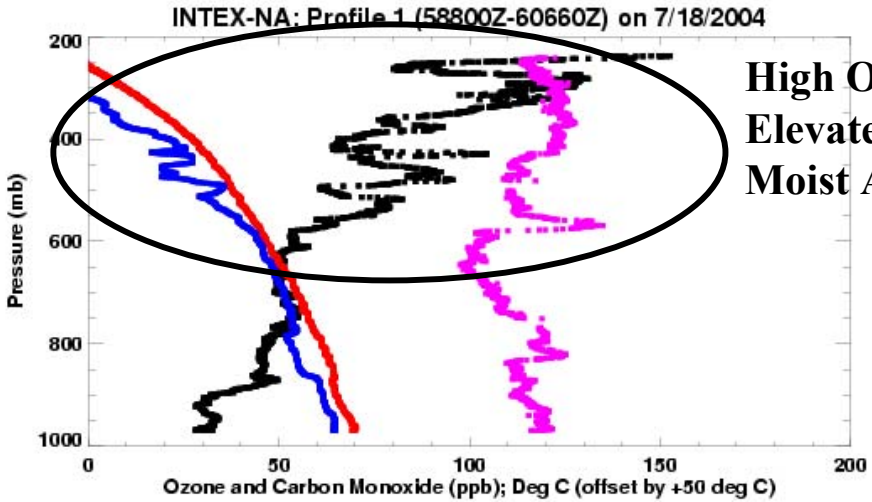


DC8 Ozone (Avery)

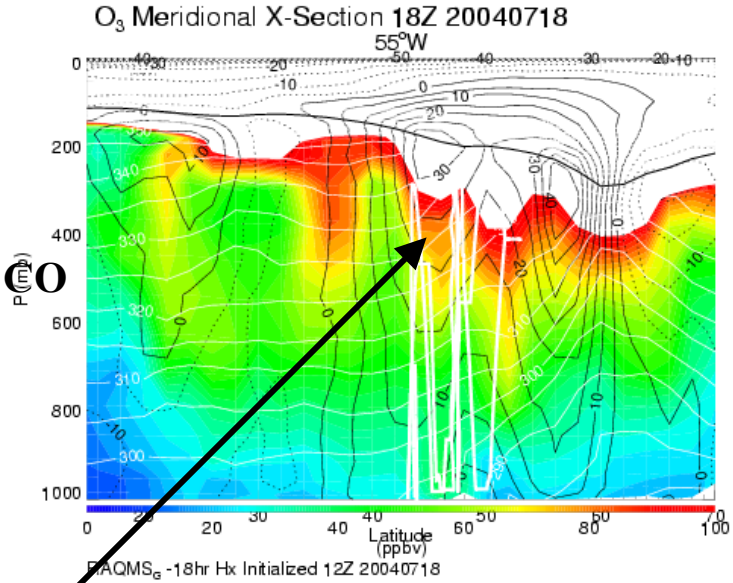
DC8 TD-LIF* (Cohen)

***Thermal Dissociation - Laser Induced Fluorescence**

Profile 1

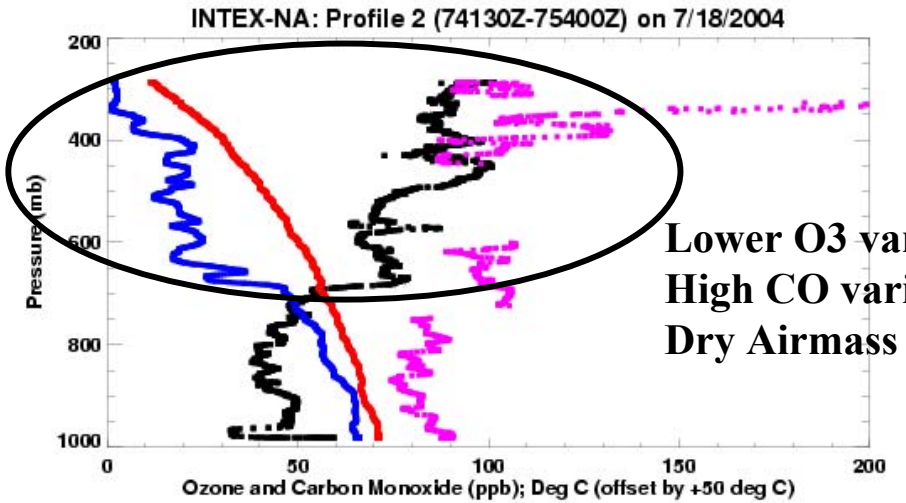


High O3 variance
Elevated, but flat CO
Moist Airmass

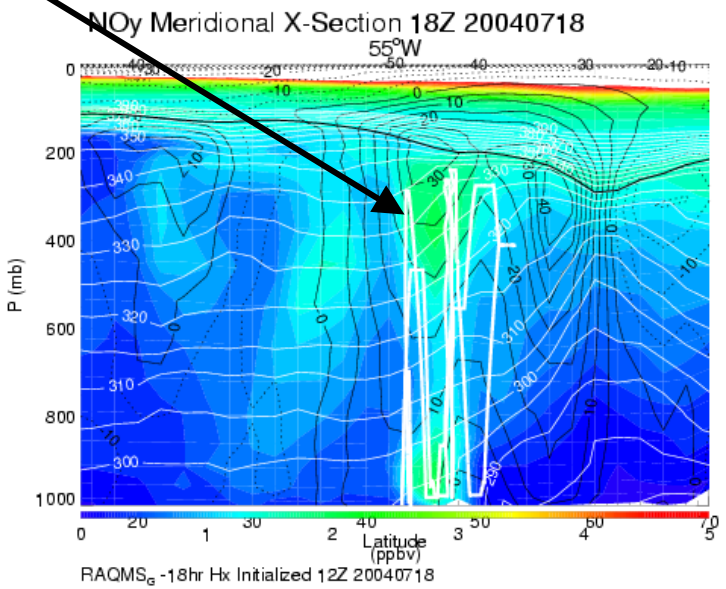


Convective lofting, Strat/trop exchange, long-range transport of Asian emissions?

DC8 Dewpoint, T, O3, CO

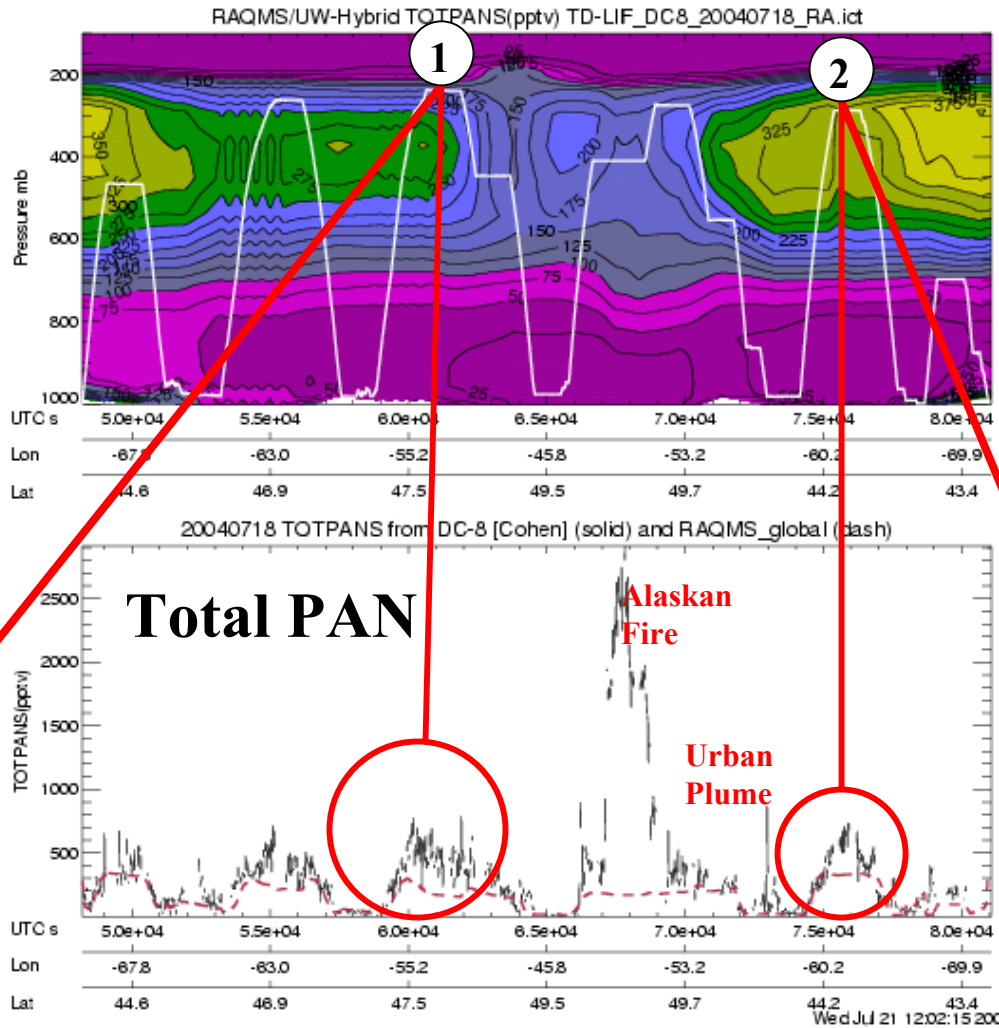


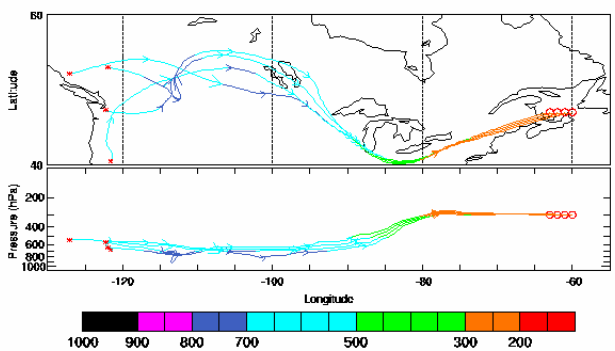
Lower O3 variance
High CO variance
Dry Airmass



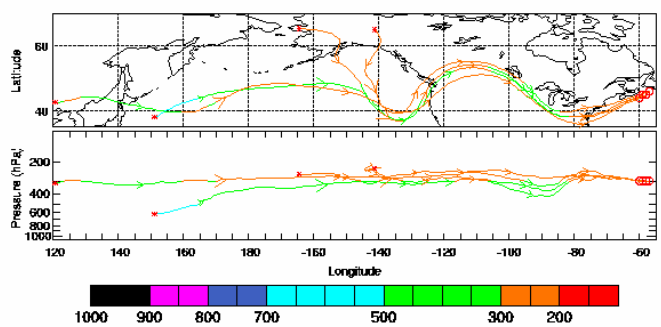
Profile 2

RAQMS/DC8 Total PAN DC8 flight # 9, July 18 2004



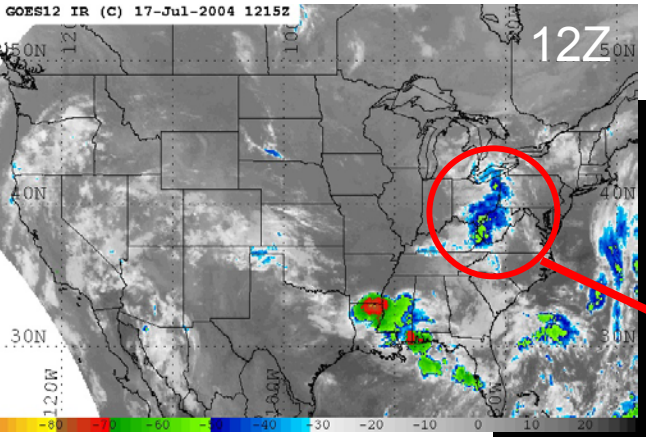


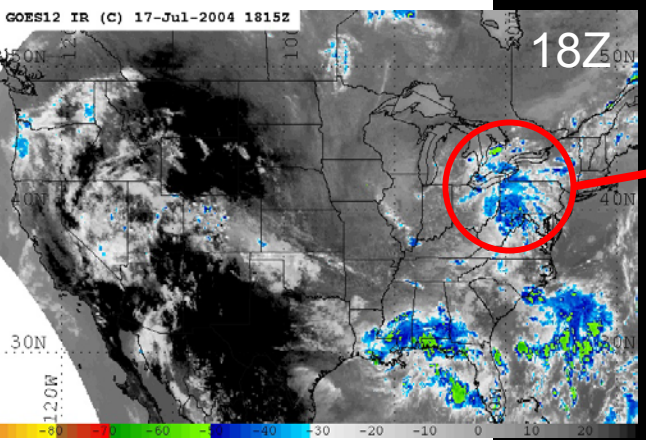
DC8 TD-LIF (Cohen)

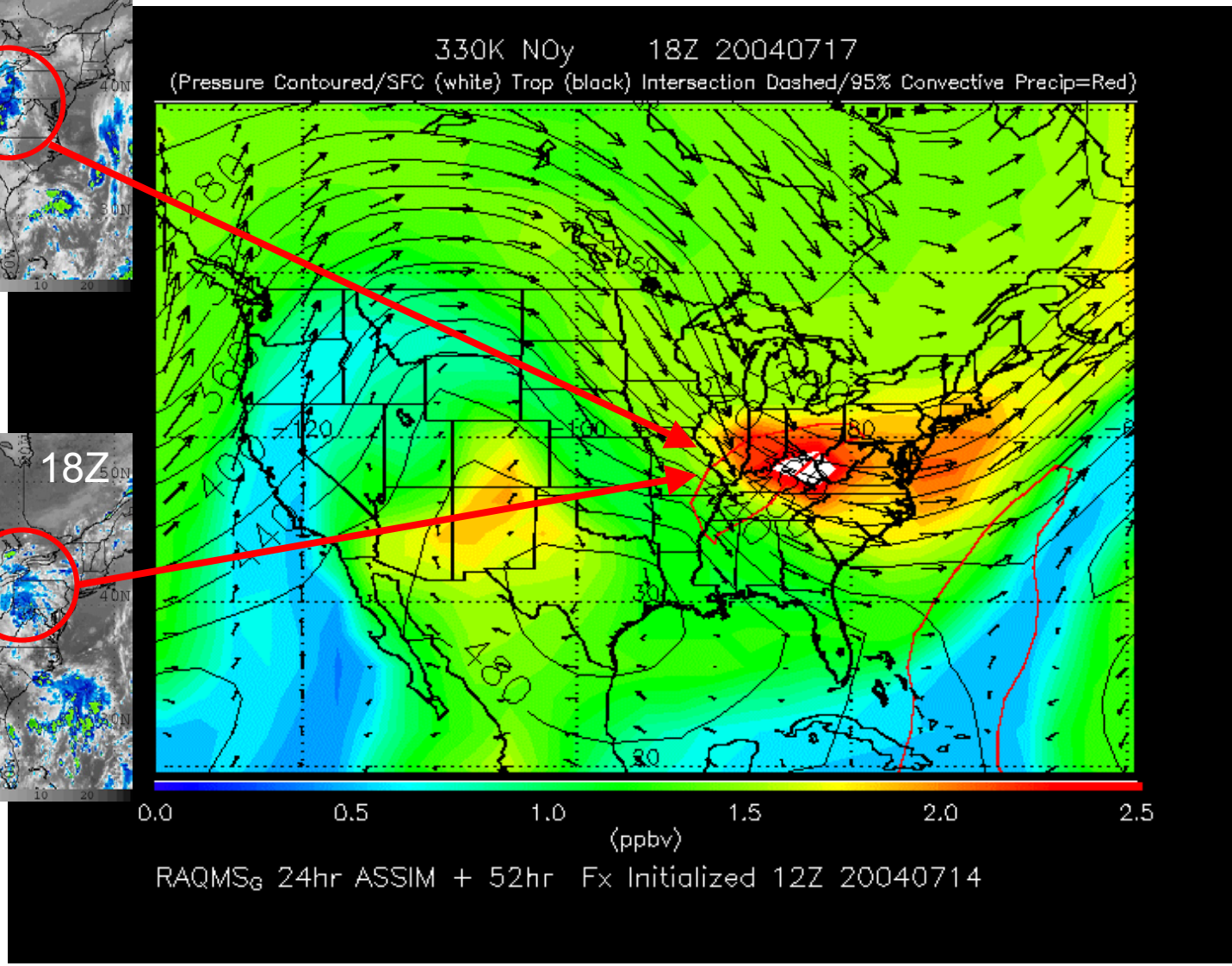


Back Trajectory (Fuelberg)

RAQMS 330K NOy 18Z July 17, 2004

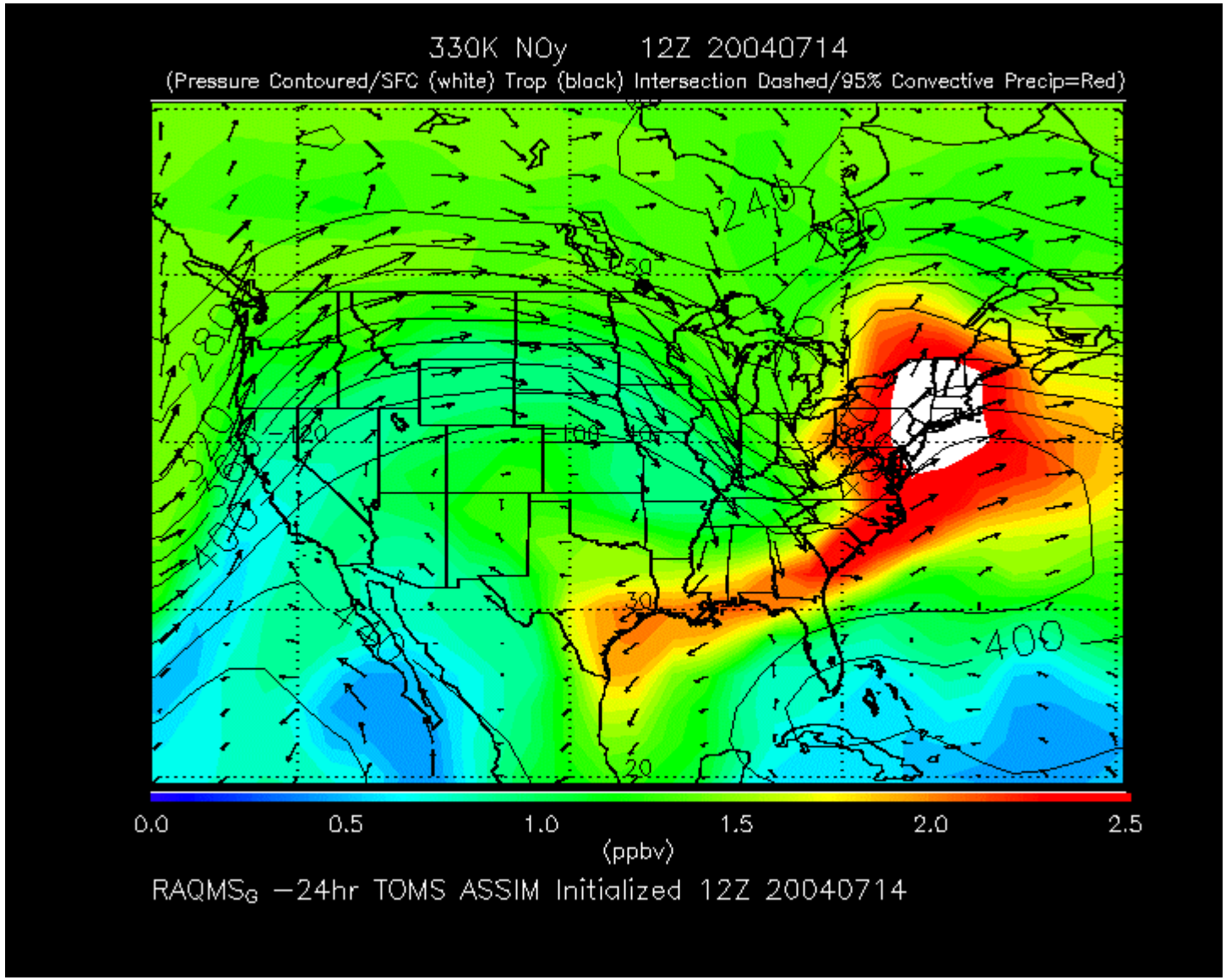






GOES Enhanced IR (David Westberg, SAIC/LaRC)

RAQMS 330K NOy Loop 12Z July 14-12Z July 18, 2004



A Climatology of Rossby Wave Breaking along the Subtropical Tropopause

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Rossby Wave breaking is an upstream source for stratospheric ozone in the upper troposphere.

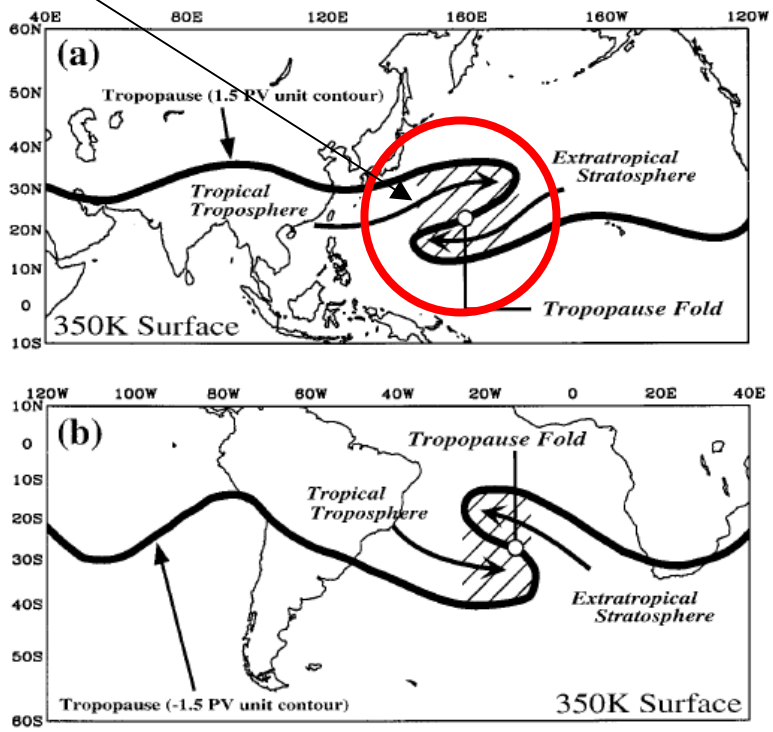
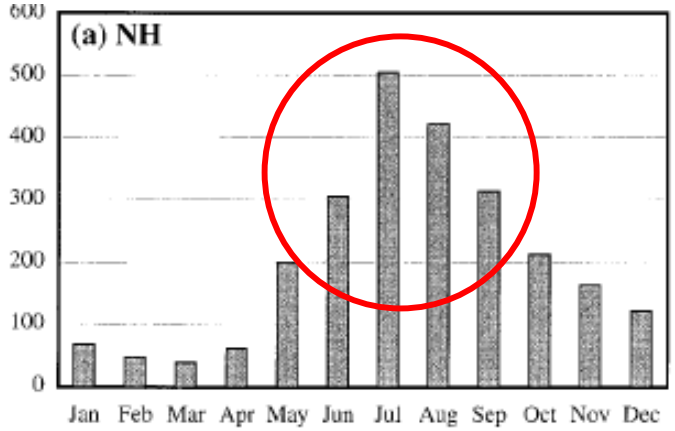


FIG. 1. Schematic of Rossby wave breaking events over (a) the North Pacific and (b) the South Atlantic, on the 350 K isentropic surface. The thick contours represent the tropopause. The hatched regions denote surf zones, where the meridional gradient of PV is regionally reversed.

Rossby Wave Folding events



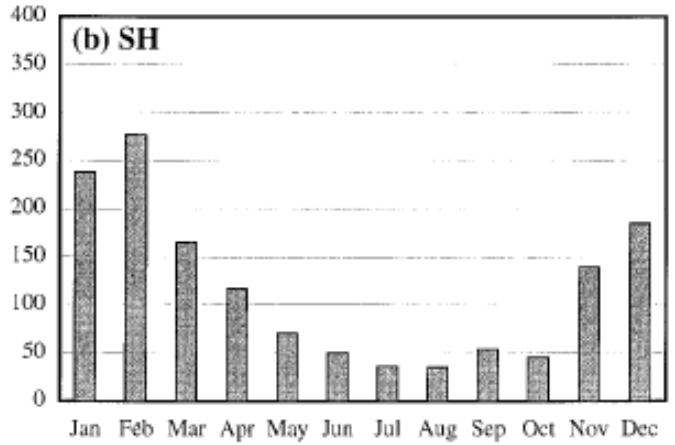
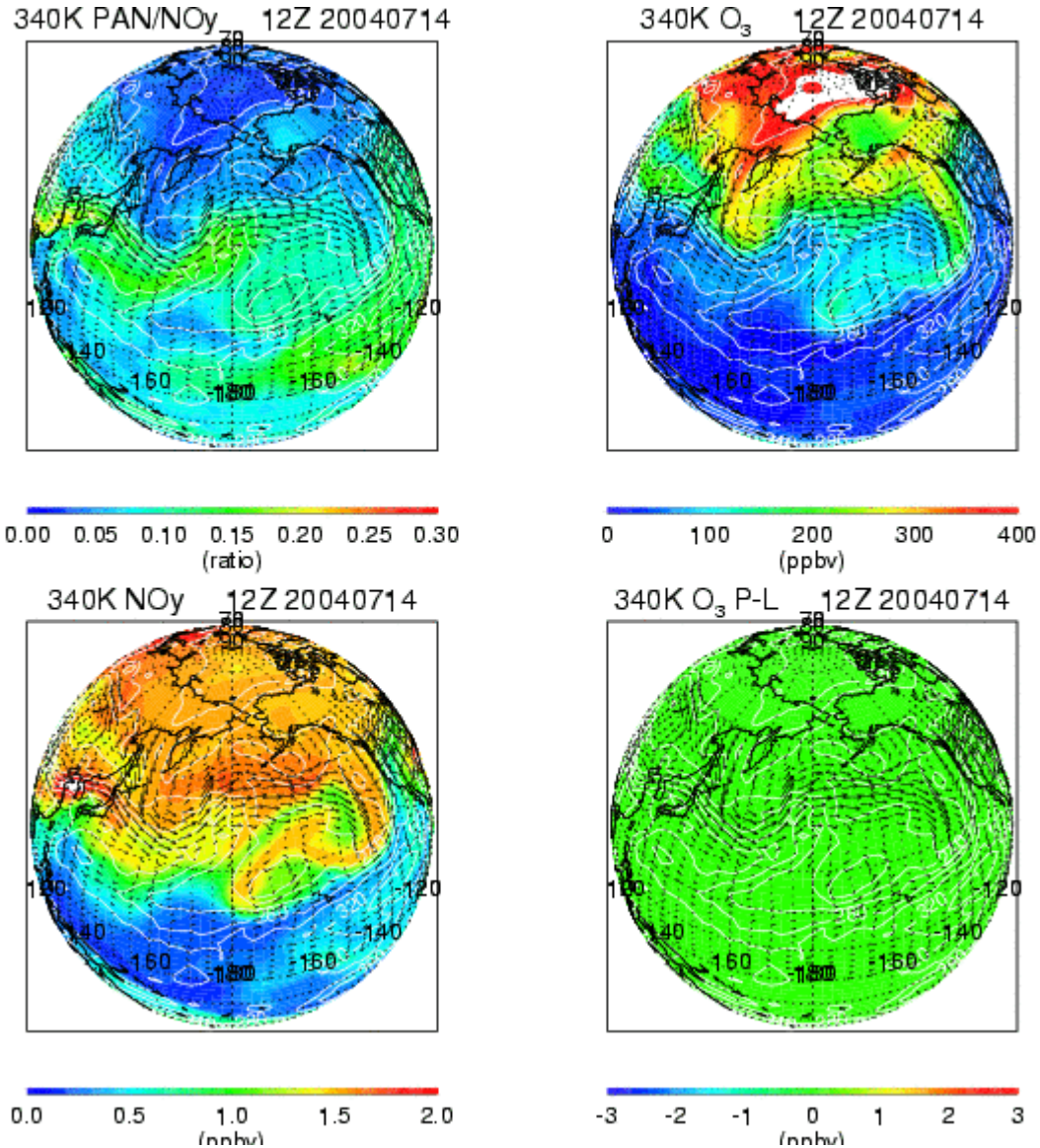


FIG. 3. Histogram of the total number of tropopause folds detected during the 1986–95 period at 350 K, as a function of month, for (a) the NH and (b) the SH.

Asian outflow is likely to be highly influenced by STE associated with Rossby wave breaking in Western Pacific during June-August.

RAQMS 340K Satellite Loop 12Z July 14-12Z July 18, 2004



Preliminary Findings:

Recent convective lofting of local emissions, long range transport[1] of Asian emissions, and both local and upstream[2] STE appear to result in elevated O3 and it's precursors in the N. American middle and upper troposphere.

1. ***Because of the persistent large amplitude trough over the eastern US, Asian emissions, mixed with stratospheric air, appear to impact the Eastern US upper troposphere.***

2. ***There is a climatological source of Rossby Wave breaking within the western Pacific during June-September (Postel and Hitchman, 1999).***